By 1903, California was America's largest oil-producing state, accounting for almost one-fourth of the country's total production with a yearly output of 24.4 million bbl. Nearest competitors were Ohio, 20.5 million bbl, and Texas, 18.0 million bbl. In 1910, the Lakeview gusher blew in, flowing an estimated 125,000 bbl/day. The well was hailed as the greatest gusher in the United States.

During the decade ending in 1919, California produced 909 million bbl of oil, more than any other state, representing one out of every three barrels produced in the nation during the 10-yr period. Closest competitors were Oklahoma, 799 million bbl, and Texas, 268 million bbl. A decade of discoveries starting with Huntington Beach in 1920 enabled California to dominate the nation's production picture through the decade of the 1920s, producing 2.1 billion bbl, or only slightly less than one out of every three barrels of the nation's oil. Discovery of the East Texas field in 1930 boosted Texas ahead of California. In post-World War II years, offshore discoveries and enhanced recovery technology kept the state in the forefront of the nation's oil production.

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Paleogeographic and Tectonic Setting of Axial and Western Metamorphic Framework Rocks of the Southern Sierra Nevada, California

In 1978, we postulated that much of the southern Sierra prebatholithic metamorphic framework consisted of lower Mesozoic siliciclastic, carbonate, and pelitic strata with variable arc volcanic admixtures (Kings sequence). Recent syntheses, however, have attempted to minimize the importance of early Mesozoic strata in the region and to extend large length scale coherent Paleozoic terranes into the framework as the predominant protoliths. Neither lithologic correlations nor structural analysis can substantiate such a view, however, and the proposed configuration of the Paleozoic terranes is in conflict with the petrochemical zonation pattern of the Cretaceous batholith.

Stratigraphic relations for the relatively well-preserved lower Mesozoic stratified rocks of the southern Sierra generally support our 1978 synthesis. As pointed out by more recent syntheses, however, we now recognize the likelihood of Paleozoic strata occurring in some or many of the Kings sequence pendants. Such rocks are more likely to be disparate fragments of a highly dismembered polygenetic basement composed of Shoo Fly, miogeoclinal, and possibly Antler-belt rocks rather than coherent terranes or crustal blocks. The lower stratal levels of the lower Mesozoic Kings sequence may have formed part of a regional post-Sonoman (Triassic) marine overlap sequence above this basement complex Dismemberment and accretion of the basement complex involved transform truncation tectonics and Foothills ophiolite belt emplacement prior to and coincident with Sonoman thrust tectonics. Following the establishment of a Carnian-Norian carbonate platform, as part of the overlap sequence, the region subsided and became part of a regional Early Jurassic forearc basin with the deposition of Kings sequence turbidites and olistostromes. The forearc basin was destroyed by the late Early to Middle and Late Jurassic thrusting, which may have been diachronous with a northward migration pattern.

The assertion that much of the Kings sequence is Paleozoic is based on the discovery of probable Eocambrian-Cambrian miogeoclinal strata in the Snow Lake pendant of the east-central Sierra Nevada. The discovers offer a reconstruction of the displacement of these strata as part of a large crustal block from the western Mojave region through the axial Sierra Nevada along a now cryptic fault. The bounds of the hypothetical crustal block, however, are at odds with batholithic petrochemical patterns. A more conservative offset history for the Snow Lake pendant rocks preserves the petrochemical patterns and considers a broader uncertainty in the bounds of the possible source area for the rocks.

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A Summary of Horizontal Wells Drilled by Shell Western E&P Inc. in Steeply Dipping Turbidite Sand Reservoirs, Midway Sunset Field, Kern County, California

The Kernridge Production Division of Shell Western E&P Inc. has drilled three successful short-radius horizontal wells in a mature steam drive in Midway Sunset Field, Kern County, California. The upper Miocene Sub-Hoyt E sands have been undergoing steam-drive development since 1978. A descending steam chest occupies more than half the average 400-ft gross E sand thickness. The horizontal wells have been drilled at the base of these sands, 10 ft above the oil-water contact. The horizontal wells should improve recovery efficiency, accelerate production, improve the oil-steam ratio, and therefore increase project profitability.

The E sand reservoir is comprised of moderately sorted, turbidite mid to upper submarine fan channel sands. The sands are massive to thin bedded, with diatomaceous shales interbedded throughout. Average depth to the oil water contact is 1350 ft. The sands dip at 45° to the northeast. Oil gravity is 13° API.

The horizontal wells have cost 2–3 times more than a vertical well. However, initial production after steam soak for the first two horizontal wells, whose average lateral length is 400 ft, has been 2–3 times greater than a vertical well. The third well has yielded 4 times greater production rates from a 700-ft lateral. Horizontal wells are a viable option for the ultimate development of the steam drive reservoirs in Midway Sunset field. A medium-radius horizontal well was planned in late 1992 for the E Sands, and studies by all engineering disciplines are underway to improve horizontal well technology and performance.

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Time-Sequence Air-Photo Interpretation for CERCLA and RCRA Investigations—A Technique That Still Works

Many new remote sensing techniques are being developed and applied to environmental investigations. However, interpretation of standard vertical public and private sector aerial photography remains a highly useful, cost effective, and underused technique applicable to such investigations. This paper illustrates the successful use of time-sequence air-photo assessment to aid in a CERCLA remedial investigation and a RCRA facility investigation.

In the first case, interpretation of air photos provided an historical evaluation of a site reported to be a buried landfill. However, more than 40 borings drilled a the site did not discover any refuse or landfill material. The air photo interpretation revealed that (1) volatile organic hydrocarbon contamination in soil and vapor samples appeared to result from surface discharge of liquids, and (2) any landfill material present was removed during facility expansion more than 30 yr ago. As a result, the site was discounted from further consideration as a landfill, thereby reducing regulatory requirements for site closure.

In the second case, time-sequence air-photo assessment conducted for a toxic waste disposal site allowed (1) determination and mapping of the construction sequence and facility modification, and (2) evaluation of general disposal